Influence of Porosity and Concentration of Impurity BeO on Elastic and Thermal Properties of SiC Ceramics

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The influence of porosity (P = 2.5; 5; 7.5; 10; 12.5; 21.3%) and concentration of beryllium oxide (0.5; 1; 1.2; 1.3; 1.4; 1.5; 2.0; 3.0 wt.%) on the sound velocity of longitudinal and transversal ultrasonic waves, the modules of elasticity, thermal expansion coefficient, thermal conductivity and heat capacity of ceramics based on the silicon carbide in an interval of temperature (300 - 1100 K) is investigated. The thermal conductivity, sound velocity, Young's modulus, bulk and shear modulus decrease with increasing porosity. It's caused by the increased concentration and average size of pores, which are basic centers of scattering and the reduction of interatomic interaction. From analysis of the experimental data the formulas for calculation of the parameters υ, K (E, B, G) with respect to porosity are offered. $\upsilon = \upsilon_0 (1 - P^{2/3})^{1/2}$, $K = K_0 (1 - P) (1 - P^{2/3})$ (K_0 - elactic parameters at P = 0) and temperature dependence $K = K_1 - b (T^2 - 300^2)$ (K_1- elactic parameters at 300 K). The effective thermal conductivity all compositions decreases with temperature as $\lambda \sim T^{-n}$ (n = 0.98 - 0.96)

With introduction of up to 2 wt.% of BeO into the SiC, the elastic parameters and thermal conductivity grow. They reach a maximum at 1.3 – 1.5%, and a minimum for thermal expansion coefficient is observed. The value of the heat capacity shows almost no change. Such bahavior is explained by filling of the vacancies in the silicon by beryllium atoms. the filling of intercrystallite space of SiC grains by beryllium oxide, because the scattering on vacancies and grain boundaries are decreased.